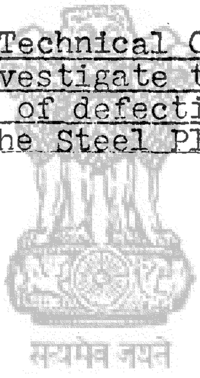
MINISTRY OF STEEL AND MINES
(DEPARTMENT OF STEEL)

# REPORT OF THE TECHNICAL COMMITTEE
SET UP TO INVESTIGATE THE REASONS FOR HIGH ARISING OF DEFECTIVES, SCRAP ETC. IN THE STEEL PLANTS

JANUARY 1973.

REPORT

of the Technical Committee
set up to investigate the reasons for
high arising of defectives, scrap etc.
in the Steel Plants.



January, 1973.

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CHAPTER 1

INTRODUCTION

1.1. The Estimates Committee in their 20th Report on Ministry of Steel & Mines (Department of Steel) have expressed their concern that in 1970-71, 12.6% of the total production of Indian Iron & Steel Co. was classified as defectives and 10.2% of the total finished steel production of Durgapur Steel Plant was classified as scrap. On their recommendation of the Estimates Committee, Department of Steel has set up this Technical Committee vide their Resolution NO.DUR 18(5)/72 dated the Ist August 1972 (copy given at Annexure I) to find out the reasons for such high percentage of production in various steel plants being classified as 'defectives', cuttings, 'rejects' and 'scrap', and also to suggest remedial measures for improving theperformance. The members of the Committee are:

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1. Shri Hari Bhushan,
   Senior Industrial Adviser,
   Ministry of Steel & Mines
   (Department of Steel) - Chairman
2. Dr. S.R. Pramanik,
   Chief Metallurgical Adviser,
   Central Engg. & Design Bureau,
   Hindustan Steel Ltd., Ranchi - Member
3. Shri P. Mazumdar,
   Asstt. General Supdt.(Mills),
   Tata Iron & Steel Co. Ltd.,
   Jamshedpur - Member

1.2. The Terms of Reference of the Committee are as under:

i) To investigate the reasons for high arisings of defectives, rejects and scrap in the rolling mills in the steel plants; and

(ii) To suggest measures to remedy the situation.

1.3. The Technical Committee had its first meeting on 17.8.1972 at New Delhi and discussed the methodology and scope of work entrusted to it and draw a suitable questionnaire to be sent to the main steel plants. The Committee visited Indian Iron & Steel Co., Burnpur, Durgapur Steel Plant, Durgapur and Ranchi during the period 12th to 16th September 1972 for collecting first hand information. The Chairman could not visit the plant as he was out of India and advised Development Officer, Department of Steel, Shri K.P. Bhat to accompany other Members on his behalf. The Committee held a further meeting at Ranchi on the 28th and 29th November 72 in which representatives of main steel plants also participated.

1.4. The Committee wishes to place on record its sincere thanks to the Steel Plants and their representatives particularly, to Dr. Lakhiani, Chief Metallurgist, IISCO, Shri P.R. ~~Mesh~~ Mah, Senior Manager, Rolling Mills, IISCO. Dr. B.R. Deoras, Chief Metallurgist, Durgapur Steel Plant for their cooperation and unstinted support in studying the problems and coming to their final views. The Committee also records its appreciation of the assistance given by Shri K.P. Bhat, Development Officer, Department of Steel, in preparing this report.

CHAPTER II

GENERAL

2.1. Production of prime quality material in a steel plant can be classified in two groups, viz:

i) Tested quality; and

ii) Off-grade/untested quality.

Every steel plant endeavours to produce maximum in the tested quality. Production in off-grade/untested qualities is, however, inherent in the flow of material in a Steel Plant and processing of steel at different stages in the plant. It arises at different stages of processing, starting from the steel melting shop upto the despatch stage of the finished products, for different reasons not always within the control of the plant. Sometimes the rolling of off-grade/untested qualities become necessary and intentional to take care of ingots/semis in stock, which might have lost their identity i.e. heat number or got rusted/pitted during storage. Also there exists a demand for galvanized corrugated sheets as well as galvanized plain sheets in untested quality since mostly these are for uses where coating is the primary consideration and uses are mainly non-industrial.

2.2. Besides the tested and off-grade/untested qualities, other saleable arisings from a steel plant are defectives, cuttings and scrap. Defectives are normally the finished products that cannot be sold either in tested or untested quality, due to technical reasons; for example, products beyond the dimensional and weight tolerance of + 5%, products having surface defects considered harmful for normal end-use etc. Cuttings and scrap are normally the arisings from

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process losses such as the discarded ends of blooms/slabs, side trimmings of flat products, short lengths of shaped products, cobbles etc. which are normal in a steel plant during rolling. This is also evident from the yields from ingot to finished or saleable steel prescribed for each plant as per their design and varies from about 68% in case of Rourkela to say 80% in case of IISCO. The residual i.e. about 20-32% is the scrap arising in the plant which could be put to such uses as, (i) recirculation to the steel melt shop for remelting along with hot metal charge from blast furnace, (ii) as saleable rerollable or industrial scrap or (iii) sold as scrap to other units or parties for remelting purposes. The bulk of the scrap arising is, however, intended for plants' own consumption in the steel melt shops.

2.3. The percentage of despatch of cuttings and scrap i.e. surplus to their own consumption, compared to their total arising in a steel plant is very small and this percentage depends upon the overall scrap balance in the steel plant and the types of steel-making process adopted, the hot metal availability, the chemical composition of hot-metal, etc. In an event, that for some reason the production of steel melt shop is interrupted or curtailed as in the case of a strike at Durgapur Steel Plant or roof collapse at Rourkela, ~~where~~ when ingots from stock had to be rolled exclusively or in much larger quantity, the scrap balance would be upset for that period and would result in larger availability of scrap for despatch. Higher despatch of

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scrap for any specific period,, therefore, is not by itself an indication of higher scrap arising in a steel plant.

2.4. Defective products arise in a steel plant at various points of operation such as:

(a) from ingots not fulfilling the desired teeming conditions i.e. with unsatisfactory surface or piping;

(b) from heats having high sulphur content or adverse sulphur manganese ratio;

(c) from semis with major surface defects;

(d) from rolling defects;

(e) from rolling of very old stock of pitted/ rusted ingots;

(f) from long storage of finished products etc.

2.5 At the steel melting shop stage, of course, normally ingots are not classified as defectives. They are classified as tested or off-grade/untested or as remelting scrap. Tested heats are those which are considered suitable for rolling into finished products of tested quality while of grade/untested heats are those which can only be rolled into off grade/untested materials that need not be tested before despatch. These materials however need to comply to certain dimensional specification and surface quality requirement.

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2.6. The defective classification starts from a stage where inspection is involved - inspection being carried

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out either by the operational men or quality control men, as the case may be.

2.7. There exist certain rolled products which, failing to meet the standard tested quality requirements, do not find any market in forms other than defectives or re-rollable scraps. Specific examples of the same are fish plate bars, finished fish plates, sub-standard wheels etc. In cases of certain other products, if they fail to meet one tested category, it may be possible to divert them into other tested grades with or without certain additional processing.

2.8. Performance of steel plants vary considerably from each other depending on their rolling mill layout, equipments, products, inspection standards and practices, finishing equipment, stacking and handling facilities and sales policies. Despatch of defectives as a percentage of saleable total despatch of one steel plant is thus hardly comparable with another steel plant. It was, therefore, considered advisable to review separately each mill's performance with the best that particular mill has already achieved.

2.9. - Another most important point to be borne in mind is that steel plants are designed for continuous operation and any unplanned interruption (i.e. other than for scheduled repairs) will have, apart from loss in production and possible damage to equipments, serious effect on the yield and the final product quality. For example, if there is unplanned interruption in soaking pit operation or soaking pit crane operation, there will be a pile up of stripped ingots and track time will increase. If the interruption at the soaking pits is a prolonged one, the hot ingots

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which are otherwise planned for direct charging into the pits will have to be diverted to stocks. If such ingots are allowed to remain in stockyard for a long time, it will lead to rusting and pitting and loss of identity and finally these ingots may have to be rolled as defectives or off-grade.

2.10. Likewise, if the slabbing or blooming mill operation is discontinued for any length of time, the heating schedule at the soaking pit will be badly affected and there might be prolonged heating involving higher scale loss and lower yield of the good blooms or slabs. Prolonged heating of ingots is detrimental to certain quality of steels as this leads to pronounced surface defects in the semis and consequent rejections.

2.11. Another example could be interruption at the steel melting shop stage leading to the production of off-grade heats, cold heats etc. for steel in process in the steel melting shop. More important, in such cases, apart from a small quantity of ingots already in the soaking pits, the primary rolling mill would have to be fed from cold ingots from the stockyard. As these ingots are not related to any orders as such and since such ingots apart from being cold will include various melts and specifications, often off grade or of lost identity etc. the arising of off-grade defectives, scrap etc. during rolling, during that period would also go up very substantially.

2.12. It would, therefore, be clear that apart from other factors, maintaining a continuous production at capacity levels would be the single most important determinant in reducing the arisings of defectives, rejects and scrap.

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CHAPTER III

DEFECTIVE AND SCRAP ARISINGS AT INDIAN IRON & STEEL CO.

3.1. The Indian Iron & Steel Co., Burnpur is an integrated steel plant, producing sections like beams, channels, angles, rounds, flats, rails and sheets, inclusive of galvanized sheets. Besides, these, they also produce special sections like bridge rails, Z-Sections, MG crossing, sleeper bars, sheet piling section, bulb angles, bulb plates, semis like hoe-bars, etc. They also produce cold twisted deformed bars for reinforcement.

3.2. During the last 4 financial years, between 1968 to 1972 IISCO had despatched different tonnages of defectives (Annexure III-1), the maximum being in the year 1968-69 in terms of absolute tonnage and in 1970-71 in terms of percentage of defectives against total despatch. The best performance was achieved in the year 1971-72, although their total despatch was lowest during this year. The technological and other working conditions remaining the same, as in the year 1971-72, it should be possible for IISCO to repeat similar performance in terms of percentage of arisings of defectives and even to improve upon it.

3.3. Since the year 1963, a large quantity of blooms/slabs gradually accumulated from the 40" mill of IISCO and by 1.4.1968 the ground stock went up to as high as 94,000 tonnes. The build up of this stock was due to the following reasons:

(a) To maintain the melting shop production to its maximum, 40" mill was operated to its rated capacity even when there had been long stoppages/break-downs in either, and/or both the receiving mills, e.g. 34" mill and Morgan Mill.

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(b) Steel made to specifications outside the mill order, i.e. off-grade were rolled into blooms/slabs and put to stock.

(c) Excessive cooling of blooms/slabs on account of delay in transfer of blooms/slabs from 40" mill to Morgan mill and consequent inability of these mills to take on such blooms/slabs for rolling.

(d) Bad surface quality of blooms/slabs.

The blooms/slabs thus accumulated could not be rolled in appreciable quantity in the 34" mill even when adequate supply of hot steel to 34" mill could not be ensured. This was due to the lack of re-heating capacity in 34" mill which has been provided with only 2 "wash-heat" type of reheating furnaces. Installation of a walking beam reheating furnace did not help in consuming this stock as the same did not work satisfactorily right from the beginning.

3.4. The recession in the industries from 1966-68 further aggravated the situation. Subsequently, when the situation improved towards the end of 1968, efforts were made to dispose of these cold blooms/slabs. As major portion of blooms/slabs were badly rusted, pitted and damaged due to long shortage, these had to be disposed of as defectives along with blooms/slabs with bad surface defects.

3.5. Apart from these blooms/slabs, some finished products also piled up in the various mill bays due to the following reasons:

(a) non-availability of wagons in time;

(b) imposition of sudden railway restriction; and

(c) other non-technical reasons.

As some of these piled up finished products got badly damaged during long storage, these also had to be disposed off as defectives.

3.6. It can be seen from Table at Annexure III-1 that despatch of defective in 1970-71 was 70,076 tonnes amounting to 12.9% of the total despatch, contributions from 40" mill and Morgan Mill were 24,653 tonnes (4.56%) and 18,308 tonnes (3.38%) respectively. These were mostly old stocks of badly rusted and pitted blooms, slabs and billets. Barring these, defective despatches were quite normal from other finishing mills. In 1971-72 when there has been hardly any despatch of old stock of blooms and slabs from 40" mill, defective despatch came down to only 5.5%.

3.7. IISCO expressed that the process technology, product-mix, equipment and other working conditions remaining the same as in 1971-72, it shall be possible to control arisings of the defectives within reasonable limit of 5 to 6 per cent of total saleable tonnage despatch.

3.8. The committee had a discussion with the representatives of IISCO as to the concrete basis of their statement with regard to their ability to control arisings of defectives within the limit of 5-6%. IISCO stated that they have a plan to liquidate accumulated arisings of blooms and slabs i.e. accumulations in the recent past by a regular fortnightly or monthly rolling progfamme on the 34" rolling mill. The regular production of the blooming and slabbing mill during this period would be taken care of by the Morgan Mill. The order of accumulations, i.e. surplus of the 40" mill blooms

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and slabs over the off-take by the morgan and the 34" mill, would be comparatively small, and for such small accumulations the reheating furnaces termed as 'wash heat furnaces' could well suffice.

3.9. With regard to the off-grade and off-heat casts, detailed investigations have been carried out by IISCO with a view to minimise their arisings. To ensure that physical properties of materials are within the specifications, working ranges for chemicals composition have been developed on the basis of statistical analysis for various specifications and, accordingly, several nomograms prepared. (It was learnt that this was already a normal practice followed by other plants). The above control procedures, according to IISCO, have already resulted in susbstantial improvement in quality. Diversion of commercial qualities in medium carbon steels decreased from an average of 5% for the years 1966-68 to an average of 1.9% for the years 1968-70. The standard quality steel as a percentage of total ingot production also improved from an average of 89.3% for the year 1966-68 to an average of 94.1% for the years 1968-70.

3.10. Surface defects in the finished products accounted for certain amount of diversions to off-grade or defective qualities. Investigation of surface defects revealed that these mostly originated from blow holes or ingot cracking during cogging. These defects from either of the origin appear to be a function of chemical composition, the section and the mill in which these were rolled. These defects have been reduced by stricter control of chemical composition, de-oxidation, teeming rates, track times, heating times, rolling temperatures

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and the extent of reduction in a particular pass in the mill. A number of recommendations have been evolved in the plant for various types of steels or reduce the surface defects and despite only partial compliance so far, according to IISCO's representative, this had led to substantial improvement in surface quality.

3.11. Inspection of finished rolled products at the cooling beds and straightening and feeding back the results immediately to the mills, has enabled the mills to control the arising of rejects to a certain extent. Compilation of inspection results which are supplied to the mills weekly as well as monthly also act as a guide to control the production of tested quality products.

3.12. IISCO expressed optimism that these and other controls at various stages of production would reduce the arisings of off-grade, defectives and scrap.

3.13. Details of steel scrap arisings at IISCO during the period of 1968 to 1972 is given in Table at Annexure III-2.

3.14. It will be seen that the percentage of scrap arising to gross steel production is varying between 16% to 18.5%. IISCO have an installed ingot capacity of 1.0 million ingot tonnes and their saleable steel capacity is 0.8 million tonnes, which would show that the planned yield of saleable steel from ingots rolled is 80% and the scrap arising as a percentage saleable steel will be 25%. In actual practice the arising of scrap has been lower than this level even after accounting for scale loss.

CHAPTER IV

ARISINGS OF SCRAP AND DEFECTIVES IN DURGAPUR STEEL PLANT DURING 1970-71

4.1 The Committee took up for examination the point raised by the Estimate Committee in their 20th report on Ministry of Steel & Mines regarding the high percentage of scrap i.e. 10.2% of the total finished steel production of Durgapur Steel Plant in 1970-71.

4.2 As per the statistics of the Hindustan Steel Limited, the total production of saleable steel in Durgapur Steel Plant in 1970-71 was 413,000 tonnes and the total despatch or rolled steel (saleable steel) was 531,000 tonnes. Besides this, 73,000 tonnes of ingot steel was also despatched.

4.3 The Committee noted that the figure of 10.2% which has been underlined by the Estimate Committee arises out of the statistical information furnished by the Economic Wing of the Department of Steel without interpretation or qualifying of the data. The figure of 34,000 tonnes of steel scrap despatches seem to have been quoted from 'Sales Statistics Supplement 70-71' issued by H.S.L. Central Sales Organisation. This figure has been revised by H.S.L. to 41,000 tonnes, in their 'Sales Statistics 70-71' but, if the despatches of turnings mould splashings, runners and discarded rolls are deducted, since they are normal process losses as distinct from scrap arisings during rolling- the earlier figure will substantially be the same. The details of despatches of semis, finished steel, defectives and scrap from Durgapur Steel Plant are given in Annexure IV-1&2.

4.4 The second aspect observed was that, in the information supplies, scrap despatches were related to the despatch

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of finished steel of 334,000 tonnes whereas actually it should have been related to the despatches of saleable steel which includes saleable blooms and billets (mainly billets). If total saleable steel is taken into account, as it should be, the figure of saleable steel despatch from DSP for the year 1970-71 being 531,000 tonnes, the scrap despatch as related to this figure comes down to 6.6% which by itself is not so high in comparison with the scrap despatched figure in the previous year.

4.5. The major part of the scrap sold from DSP in 1970-71 consisted of 22,600 tonnes of mill scrap. From the statistical figure of HSL, it is noted that sale of mill scrap was resorted to by DSP with effect from 1970-71 only. Apparently this became necessary on account of the decreasing production level from DSP Steel Melt shop. If production was running to higher level such mills scrap would have been consumed by the plant itself in their steel melting shop. As such, the sale of this scrap should not be misunderstood as scrap arising at the expense of good production. It was a part of normal arising during rolling, related to yield factor of different mills but sold outside because of the inability of the steel melt shop to take normal quantities.

4.6. Consideration of the mill-wise yield and the overall yield of the plant was, therefore, considered more important. The Committee found the situation fairly satisfactory which indirectly meant that the arising of the

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process scrap was within normal limits. For example, the yields in 1970-71 was about 87.6% in the blooming mill, 94.5% in the billet mill, 90.4% in the section mill, 93.86% in the merchant mill and 75.4% was the overall yield. This can be considered as quite satisfactory considering the working conditions in the plant. The rest of 11,400 tonnes of scrap sold by DSP in 1970-71 consisted of normal arisings from the plant in the form of roll spoils, scrappy blooms, cobbles. The percentage of arisings during the year, according to the Committee, are quite satisfactory.

4.7. The Committee also considered it desirable to examine the question of defectives in DSP, since at IISCO it is the defectives which has been pointed out by the Estimate Committee. While examining the question of defectives the Committee noted that DSP despatched 52,600 tonnes of defectives in 1970-71 i.e. about 10.5% of the total rolled steel despatched. This figure, as against the corresponding figure of 6% in 1968-69, appeared to be high to the Committee. While analysing the figures of defective despatch in details, it was noted that about 19,000 tonnes of defective blooms were sold this year of which 6,000 tonnes happened to be the arisings from past accumulation and about 12,000 tonnes resulted from the cold and scrappy ingot rolled during September 1970 when steel melting shop of DSP was on strike followed by a lock-out. Besides this, about 4,000 tonnes of defective axles were also despatched in 1970-71. From the statistical figure the Committee observed that during 1969-70 about 1,300 tonnes of defective axles were despatched

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while between 1967-69 around 700 tonnes of such materials were sold. This shows that the high tonnage of defective axles despatched during 1970-71 was from the accumulated stock during 1967-69.

4.8. It is also to be borne in mind that during 1970-71 the economy had picked up substantially after recession, the demand for all steel products was high and shortages were being felt. This was an additional incentive to the plant to reduce their inventory and, at the same time, to that extent relieve shortages by the disposal of the accumulated stock of defectives.

4.9. Deducting 22,000 tonnes of defectives which resulted from the accumulated stock from the previous years, the defective despatch comes to about 30,000 tonnes which was about 6% of the total despatch and the same appeared to the Committee to be quite normal.

4.10. The Committee considered that problems like arisings of defectives and scrap are really difficult to be examined in isolation, but have to be considered in the overall context of working and efficiency achieved in the working of the plant. The labour conditions in the plant along with certain other factors, as is well known have resulted in intermittent working of the plant. Production in different sections of the plant is quite often shut down and restarted and run. An integrated steel plant with all the facilities integrated to each other with a continuous flow, material balance and heat and energy balance are such that the working conditions referred to earlier are very abnormal and deleterious for the efficient

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working of the plant. If the plant is run in a normal condition and in a continuous operation so essential and imperative for an integrated steel plant, there would automatically be an overall improvement all around which would automatically lead to improvement in the arising of defectives and scrap, etc. i.e. such arisings would get reduced. The Committee's view is, therefore, that there is not much point in recommending measures in isolation limited to the aspect of defective and scrap but rather that necessary measures should be taken by the Government for restoring the plant to normal working.

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CHAPTER V

DEFECTIVE AND SCRAP ARISINGS AT TATA IRON AND STEEL COMPANY, ROURKELA STEEL PLANT AND BHILAI STEEL PLANT

5.1. The Committee then examined the arisings of defectives and scrap at TISCO, Rourkela Steel Plant and Bhilai Steel Plant. The summary of the information from these plants is given in Annexure V I, V2 and V 3. For details please see Annexure V 4 to 13.

5.2. In case of TISCO it is seen that at full capacity the total saleable steel to be produced is 1.5 million tonnes from 2 million tonnes ingots giving an yield factor of 75% from ingots to saleable steel. As against this, the actual yield has been ranging from 77.75% to 78.6% which is actually better than the theoratical yield and as such the Committee considers that scrap arisings at TISCO is not at all unsatisfactory. As far as arisings of defectives are concerned it is seen that the arisings have been in the range of 6.46% to 6.93% and have been steady at these levels.

5.3. In case of Rourkela Steel Plant, as per Project Report, they are required to produce 1.225 million tonnes of saleable steel from 1.8 million tonne ingots which gives an yield figure of 68%. The actual performance shows that during the years 1968-72 the actual yield has been in the range of 69 to 72.5% which is also quite satisfactory and shows that the scrap arisings have been well under required levels. The arisings of defectives during these periods has been in the range of 2.5% to 3.9% which the Committee considers to be a good performance.

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5.4. On similar lines the yield at Bhilai Steel Plant is required to be at 78.5%. During the periods 1968-72 it is seen that the ratio of saleable steel to ingots rolled show a yield of 79.5% to 81% which is better than the yield assumed in the Project Report. The defective arisings during the same period has been less than 4.4% which is considered satisfactory.

5.5. In these steel plants the performance has been satisfactory and with a higher level of technological discipline there may be scope for further marginal improvements.

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CHAPTER VI

CONCLUSIONS AND RECOMMENDATIONS

6.1.1. Unplanned interruptions in steel plant operations, apart from leading to loss in production and possible damage to the plant and equipments, have greatest impact on the yield of saleable products and product quality.

6.1.2. The Committee recommends that the Government and the Steel Plant managements take all possible steps to run the plants without any unplanned interruptions and restore the working to aapacity levels. It is working to capacity level which would generate the optimum level of discipline and coordination, result in proper flow of material and energy and heat balance which would have a marked all round improvement in yields, arising of defectives, scrap etc.

6.2.1. Stocking of ingots and semis for long periods in the stockyards leads to rusting and pitting, which, on further processing, yield higher percentage of defectives and scrap. Charging cold ingots also leads to higher arisings of defectives and scrap.

6.2.2. It is recommended that the steel plants in general and the Durgapur Steel Plant in particular should take effective steps to liquidate their stocks of ingots and semis. The current arisings should be processed into finished products expeditiously and ingots and semis should not be allowed to be stored in the stockyard over long periods. If these materials cannot be processed immediately, the steel plants might consider selling out these products instead of storing over long periods.

6.3.1. Mix-up of ingots/semis leads to high arisings of off-grades.

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6.3.2. Proper maintenance and the retention of identification of ingots/semis/finished products should be carefully attended to by improved marking/re-marking methods or by hot stamping techniques.

6.4. ISI may consider evolving a suitable standard for commercial grade steel products produced from ingots/semis whose cast identity has been lost, but by individual sampling or other methods, could be categorised into certain analysis groups.

6.5.1. Frequent mutual consultations amongst steel plants would help them improve production and maintenance techniques and achieve higher technological discipline.

6.5.2. It is recommended that suitable technical liaison Committees consisting of members from all the main steel plants should be set up which should meet periodically for exchange of views. Each main production area may have separate Committees.

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6.6. Steel plants should make continuous efforts to bring down arisings of defectives and scrap at each process stages by enforcing higher level of technological disciplines and frequent review of actual performance and take remedial measures where necessary.

6.7. In Bhilai Steel Plant bulk of the rejections have been due to running stopper teeming of ingots. This should be remedied by using better refractories and practices. The ~~Scarfing~~ Conditioning of rail blooms should be intensified and more rigorous quality control and inspection should be undertaken to reduce the arisings of untested/off-grade arisings of rails.

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ANNEXURE I

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(To be published in Part I Section I of the Gazette of India)

GOVERNMENT OF INDIA
MINISTRY OF STEEL AND MINES
(DEPARTMENT OF STEEL)

NO.DUR-18(5)/72. NEW DELHI 1st August 1972

RESOLUTION

In their 20th Report on Ministry of Steel & Mines (Department of Steel) - Planning, Development, Production and Distribution of Iron & Steel and Ferro-Alloys, the Estimates Committee have observed that they are concerned to note that, in 1970-71, 12.6 per cent of the total production of Indian Iron & Steel Company was classifed as 'defectives' and 10.2 per cent of the total finished steel production of Durgapur Steel Plant was classified as 'scrap'. The Committee are of the view that this percentage is on the high side especially in the context of the acute shortages of steel being felt all over the country. As the higher percentage of 'scrap' and 'defectives' etc. ultimately result in higher cost of production in the steel plant, the Committee have urged that Government should impress upon the steel plants the need to make concerted efforts to reduce this percentage to the minimum possible. The Committee have also recommended that Government may get the matter examined by a higher-powered independent technical committee to find out the precise reasons for such high percentage of production in various steel plants being classified as 'defectives', 'cuttings' and 'scrap' and suggest remedial measures for improving the performance.

2. Govt. have accepted this recommendation of the Estimates Committee and have accordingly decided to appoint a Technical Committee consisting of the following officers:-

1) Shri Hari Bhushan,
Senior Industrial Adviser,
Ministry of Steel & Mines,
(Deptt. of Steel) - Chairman

2) Dr. S.R. Pramanik,
Chief Mettallurgical Adviser,
Central Engg. Design Bureau,
Ranchi. - Member.

3) Shri P. Majumdar,
Asstt. General Supdt. (Mills),
Tata Iron & Steel Co. Ltd.,
Jamshedpur. - Member.

.......2/-

3. The terms of reference of the Committee will be as under:

i) To investigate the reasons for high arising of defectives; rejects and scrap in the rolling mills in the steel plants; and

ii) to suggest measures to remedy this situation.

4. The Committee will submit its report to Government by the end of September 1972.

Sd/- K.V. Ramanathan
Jt. Secretary.

ORDER: Ordered that this may be published in the Gazettee of India for general information.

Sd/- K.V. Ramanathan
Jt. Secretary.

To

Manager, Govt. of India Press,
Faridabad.

Copy foraarded to:-

1. Senior Industrial Adviser (Shri Hari Bhushan),Deptt. of Steel).
2. ShriS.R. Paramanik, Chief Metallurgical Adviser, CEDB, Ranchi.
3. Shri P. Majumdar, AGS(Mills), TISCO, Jamshedpur.
4. Chairman, HSL, Ranchi.
5. Managing Director, TISCO, Jamshedpur.
6. Custodian, IISCO, Martin Burn House, Calcutta-1.
7. Managing Director, MISL, Bhadravati.

Nos. 4 to 7.

They may kindly furnish to the SIA data on the yield of defectives, rejects and scrap from each of their mills over the last five years, the reasons for increase in the yield of these year by year and steps taken to reduce the high yields. The reasons for high yield may be explained in details and it may be defined whether the high yield has been due to quality of steel at ingot stage or raw materials used for steel making or during rolling and finished stages.

Sd/- R. Mallikarajunan
Under-Secretary.

ANNEXURE II

Technical Committee set up to investigate reasons for high arisings of defectives/rejects in the steel plants

QUESTIONAIRE

1) Please fill up the Proforma I & II enclosed for the period 1968-1972 for each financial year as well as first quarter of 72-73.

2) The terminology of tested, off-grade, untested, defective, scrap and cuttings is explained in Annexure I. Please elaborate whether your plant practice conforms to these terminologies. In case there is any variation at any particular stage, please explain in detail about the product and the mill separately.

3) Whether your plant has norms for the arising of defectives, scrap and off grades. If so what are these norms. The reasons for increase/decrease in the defectives, scrap and off grades from the accepted norm during a particular period may be elaborated.

4) If any investigation has been carried out to study the higher arisings of off grade/off heat/defective cuttings/s-crap, a copy of the Report may be furnished. Also indicate whether the recommendations suggested have been implemented. If not, give reasons. If implemented, elaborate whether steps taken have given the expected results.

5) What are your suggestions for decreasing the arisings of off grade/defective/scrap etc.

Indent is placed on the steel melting shops giving suggested analysis according to the specifications for the different sections being rolled on the particular day in different section mills. During steel melting stage the steel melters are given analyses of test samples sent to chemical laboratory from furnace stage within reasonable time so that they can tap the steel according to the analysis asked for. Between the time they get this information from the chemical laboratory and the time of tapping, certain failures may take place due to which the steel made, even though the preliminary analysis had shown that after tapping the heat might conform to the required analysis, this particular heat may be fitted into some other tested grade, which may not be able to be rolled immediately. Such heats, though not fitting into the quality and the sections being rolled at that time, might still be fitted as a tested material for a later date for some other sections. In such cases, the steel melters are not penalised even though they are marked off for the day. The heats which do not conform to any of the requirements for tested grades or any sections are termed as off-grades. Heats, whose analysis are extremely bad due to high sulphur or phosphorous content or manganese being too low, which may lead to difficulties in rolling in Primary Mills due to collors and in Finishing Mills due to scrap accumulation, are declared as scrap. Besides, analysis being out, it might be due to bad teeming practices also, leading to bad surface of the ingots, the heats may be turned as scrap.

The off-grade heats which cannot go for any of the tested grades for any sections on subsequent days are normally rolled into billets and given to the re-rollers as off-grade billets. But the producers also roll them in their own finishing Mills if they have orders for off-grade quality with them.

The ingots which are declared scrap cannot be rolled at all and it is sent back to the Steel Melting Shops for melting purposes. Thus at the ingot stage, the classification is either tested or offgrade or scrap,. Within the 'tested' grade, according to ISI specification, is included both 'tested' as well as 'commercial' grades of steel. Thus the material which is rolled from ingots is either tested, commercial or off-grade, which classification is maintained upto the final stage of rolling.

In the finishing stage, the classification of material, depending on the mills, would be as follows:

At the final stage, the test pieces are taken and on the result of chemical and physical tests and also if the product do not compare favourably with the ladle sample analysis of the parent material, the products are termed as off-grade. Materials which do not conform to the section tolerances specified by the required specifications of ISI, Lloyds or any other - they are termed as 'defective'. Besides, in case the surfaces of the finished products appears to be non-smooth (scrap adhering) cracks, etc. materials are also termed as 'defectives'. This might be arising out of improper heating practices at the rolling stages.

For the purpose of saleable steel, these defectives and off-grades materials are also taken into account. Each finishing mill produces cuttings, which are too short to be sold for prime uses. Categories not included in the saleable steel are scrap for re-melting, which is normally generated at the primary mill stage, scrap for rerolling purposes termed as industrial or re-rolling scrap, cuttings which can be either for remelting purposes or which can be used by small scale industries directly.

Saleable steel from the primary mills, blooms and slabs-rejected due to off analysis or test failures are termed as untested, as against the term 'off grade' which is normally adopted at ingot steels as well as for other finish rolled products.

PROFORMA I

Name of Producer:
Period:

Qty in Metric tonnes:

Categories	Total Prodn	Tested			Off heat/Off grade			Scrap			Remarks
		Qty	% of total		Qty	% of total		Qty	% of total		
			Standard	Actual		Standard	Actual		Standard	Actual	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Steel Ingots											
Basic oxygen or open hearth											

PROFORMA II

Name of the Producer:

Period:

Categories (Millwise/ Productionwise)	Gross saleable steel production	Gross yield		Tested and Commercial			Defectives			Off grade and/or untested		
		Standard for the mill/ sections	Actual	Qty.	% of saleable steel		Qty.	% of saleable steel		Qty.	% of saleable steel	
					Standard	Actual		Standard	Actual		Standard	Actual
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)

Under Column (1) the following products may be covered:

I. SEMIS

1. Blooms
2. Slabs
3. Billets
4. Bearing plate bars
5. Fish plate bars
6. Skelp bars
7. Sheet/ tin bar
8. Sleeper bars
9. Others

II. Finished Sections

1. Rails (Light)
2. Rails (Heavy)
3. Fish plates
4. Sleepers
5. Squares
6. Sheet piles
7. Wheels/tyres Axles
8. Rounds
9. Rods in coils
10. Torsteel
11. Flats
12. Angles
13. Channels
14. Beams
15. Plates
16. HR sheets
17. Black sheets (pack rolled)
18. HR coils
19. Skelp
20. Silicon steel sheets
21. Galvanised sheets(cold rolled)
22. Galvanised sheets(pack rolled)
23. CR sheets
24. CR coils
25. Cold rolled electrical tinplate
26. Cold rolled hot dip tinplate
27. Pipes
28. Others

Scrap for re-rolling			Industrial scrap (cuttings etc. suitable for industrial use)			Remelting Scrap			REMARKS
Qty.	as % of saleable steel		Qty.	as % of saleable steel		Qty.	as % of saleable steel		
	Standard	Actual		Standard	Actual		Standard	Actual	
(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)

ANNEXURE III-1

INDIAN IRON & STEEL CO. LTD

Millwise production and despatch of saleable steel and defectives during years 1968-69 to 1971-72.

Year	Mill	Total production	Saleable production	Saleable despatches including defectives	Defective despatches	Defective per cent of	
						Saleable despatches.	Total prodn.
1968-69	40"Mill	712607	1988	2409	639	26.6	.09
	34"mill		153214	169809	18787	11.4	
	Morgan mill.	501101	81324	99230	20279	20.7	4.05
	18"Mill		113972	128711	13195	10.2	
	M&R Mill.		155983	148553	9873	6.6	
	Sheet mill		131826	128317	8433	6.6	
	Internal consumption			797			
	TOTAL:		638307	677826	71206	11.1	
1969-70	40"Mill	637276	848	6862	6192	90.2	.97
	34"Mill		153781	144090	9596	6.6	
	Morgan Mill.	429559	57135	50757	14810	29.2	3.47
	18"Mill		103443	101609	3463	3.4	
	M&R Mill		146332	157864	5670	3.6	
	Sheet Mill		104878	110495	7647	7.0	
	Internal consumption			4750			
	TOTAL.		566417	576427	47378	8.2	
1970-71	40"Mill.	576252	253	24711	24653	99.8	4.28
	34"Mill		145546	139711	11573	8.5	
	Morgan Mill.	379657	21622	25827	18308	71.0	4.83
	18"Mill.		92278	101909	2712	2.7	
	M&R Mill.		134996	130508	4892	3.7	
	Sheet mill		112497	114383	7938	6.9	
	Internal consumption.			3326			
	TOTAL.		507192	540375	70076	12.9	
1971-72	40"Mill	562507	163	611	611	100	11
	34"Mill		130829	116436	3267	2.8	
	Morgan mill.	381665	21897	21965	9462	43.0	2.48
	18"Mill.		95657	95536	2082	2.1	
	M&R Mill		146790	150395	4034	2.7	
	Sheet Mill		103798	102508	7827	7.6	
	Internal consumption.			6481			
	TOTAL:		499134	493932	27283	5.5	

ANNEXURE III-2

INDIAN IRON AND STEEL COMPANY LTD

STEEL SCRAP ARISING (IN TONNES)

	1968-69	1969-70	1970-71	1971-72
Ingot Butt	5115	5198	5076	4515
40" Mill scrap	54760	50060	2290	41770
34" Mill scrap	9250	8900	8600	7750
Billet Mill scrap	10650	9080	8060	8100
18" Mill scrap	3640	3350	3070	3110
M & R Mill scrap	7365	6798	6089	6433
Bar Yard Scrap	5311	4133	4234	3796
Sheet Mills shearings	24904	20315	22410	20815
Misc. Scrap	19777	11321	16360	2874
Total	140772	119155	116198	99163
Gross steel production.	776603	609768	626964	617139
Scrap %	18.2%	17%	18.5%	16%
Excluding Butt. ends	17.5%	16.2%	17.7%	15.3%

ANNEXURE IV - I

Quantity ('000 tonnes)

DESPATCHES FROM DURGAPUR STEEL PLANT (SUMMARY)

	1968-69	1969-70	1970-71
Ingots	33	145	73
Semis	145	127	110
Finished steel	390	392	347
Defectives	34	116	73
Steel scrap	7	17	41

ANNEXURE IV - 2

DESPATCHES OF DEFECTIVES AND SCRAP - DURGAPUR (TONNES)

Product	1968-69	1969-70	1970-71
Steel scrap			
Roll spoils	-	790	2346
Cuttings	-	-	171
Turnings	-	3334	4843
Fluted Ingots	4700	--	521
Mould Splashings	-	-	697
Bottom plate bones	-	-	-
Runners	-	-	942
Steel rolls	-	-	-
Fine steel scrap	2305	741	-
Steel cheeses	-	-	-
Discarded roll	7	1159	497
Misc.	88	-	-
Mill scrap	-	11366	22609
Scrappy blooms	-	-	1232
Mild steel scrap	-	-	4862
Skdlp cobbles	-	-	2396
Total	6629	17390	41116
Defectives			
Beams	1395	1217	1428
Channels	686	813	668
Rounds	2831	617	827
Angles	546	175	413
Plate	94	12	35
Rails	-	3	-
Bearing Plate Bars	1922	1911	1780
Fish plate bars	901	3392	1811
Fish plates	489	97	581
Sleeper bars	7486	331	6193
Sleepers	2826	3226	359
Billets	12766	21984	6217
Blooms	1128	12533	18956
Slabs	-	3016	3842
Wheels	-	239	24
Axles	429	1303	3947
Ingots	101	64775	20073
Skelp	-	814	5494
Squares	-	-	5
Total	33600	116338	72653

ANNEXURE V - I

TATA IRON AND STEEL CO. LTD

QTY: 000 TONS

Defective Arisings

Capacity Ingots 2000 Saleable Steel 1500 Yield 75%

	1968-69	1969-70	1970-71	1971-72
Ingots rolled	1858	1822	1767	1763
Gross production*	1465	1440	1374	1387
Gross yield %	77.95	78.8	77.75	78.6
Defective arising	97	98	89	96
% of defective arising to total saleable steel production.	6.61	6.83	6.46	6.93

* Includes wheels & Tyres.

सत्यमेव जयते

ANNEXURE V - 2

ROURKELA STEEL PLANT

Defective arisings.

QTY IN '000 TONES

Capacity	Ingots 1,800	Saleable steel 1225		Yield 68%
	1968-69	1969-70	1970-71	1971-72
Ingots rolled	1090	1095	990	858
Gross saleable steel production	773	796	684	597
Gross yield from ingots to saleable steel. %	70.7	72.5	69	69.7
Defective arising	30	20	23	19
% of defective arising to total saleable steel production.	3.9	2.5	3.4	3.2

सत्यमेव जयते

ANNEXURE V - 3

BHILAI STEEL PLANT

(Quantity in '000 tonnes)

Defective Arisings

Capacity Ingots 2500 Saleable steel 1965 Yield 78.5%

	1968-69	1969-70	1970-71	1971-72
Ingots rolled	1720	1845	1945	1875
Gross saleable steel production	1380	1496	1550	1518
Gross yield from ingots to saleable steel.	80%	79.5%	79.5%	81%
Defective arising	56	54	23	67
% of defective arisings to total saleable steel production	4.05%	3.6%	1.5%	4.4%

सत्यमेव जयते

ANNEXURE V - 4

Despatches of Defectives and Scrap - Bhilai (tonnes)

Product	1968-69	1969-70	1970-71
Steel Scrap			
Cuttings	691	12881	3517
Defectives			
Sheet Bar	-	-	1871
Billets	60004	33789	3710
Structurals	9357	9171	6183
Merchant Products	11619	7300	7144
Crossing Sleeper Bars	-	93	-
Wire rods	10901	10326	13179
Ingots	-		1172
Total	91881	60679	33259

ANNEXURE V -5

DESPATCHES OF DEFECTIVES AND SCRAP - ROURKELA (TONNES)

Product	1968-69	1969-70	1970-71
Steel Scrap			
plate cuttings	7842	5912	5083
plate shearings	11915	5227	-
H.R.S. Cuttings	267	289	786
C.R.S. Cuttings	5567	6581	4414
Coils ends	4628	4794	6084
H.R.S. Trimmings	-	75	-
Pipe End cuttings	492	1402	1695
D.D.R.L. Coils	1845	5510	4066
RDBI rolls	-	-	567
Misc. Steel Scrap	419	108	382
Tin Plates W/W/W(Scrap)	671	387	1698
Wagon scrap	-	3440	-
Rusted coil ends	-	-	-
Steel skull scrap	-	-	-
Ingot cuttings	-	-	-
Surgace Scrap	-	-	-
Scrap ingots	-	-	-
Slab Crop ends	-	-	-
High Silicon Scrap	733	5689	6103
Scrap from Glav. Plant	-	83	-
Total	34373	39497	30878

सत्यमेव जयते

Defectives	1968-69	1969-70	1970-71
Defectives Plates	8072	5514	5886
Defective damaged HRcoils	8044	13919	8193
Defective HR sheets	5494	2534	1977
Defective damaged CR coils	1303	862	1649
Defective CR Sheets	13400	7508	8718
Defective Rejected slabs	-	-	-
Defective GP sheets	1761	2476	3719
Defective GC sheets	145	141	394
Defective electric sheets	143	1160	1254
Defective tin plates	-	-	2862
Total	38362	34114	34652

ANNEXURE V-6

Name of Producer: Tata Iron & Steel Co. Ltd.

Mill Performance during 1968-1969

Mill & Section:	Gross Production t	Gross Yield %	Tested and commercial t.	Tested and commercial %	Defectives t	Defectives %	Untested t.	Untested %	Off-grade t.	Off-grade %
Blooming Mill No.1		89.8								
Blooms	-		-	-	-	-	-		-	
Slabs	-		-	-	-	-	-		-	
Blooming Mill No.2		84.3								
Blooms	5,443		1,808	31.4	3,725	68.6	-	-	-	
Slabs	5,189		1,886	36.3	213	4.1	3,090	59.6	-	
S.B.&.B.M.No.		96.3								
Billets (110761)	110,251		58,068	52.42	14,871	13.44	-	-	37,822	34.14
Blooms	-		-		-		-	-	-	
Skelp bars & slabs	12,339		144	1.17	11,114	90.06	1,081	8.77	-	
S.B.&.B.M.No.2		95.6								
Billets	107,214		89,516	83.49	4,568	4.26	-		13,130	12.25
Blooms	8,430		1,936	22.95	3,675	43.50	2,719	33.55	-	
Skelp bars & slabs	8,269		970	11.73	7,188	86.93	111	1.34	-	
Tin bars	105,051		104,704	99.67	347	0.33	-	-	-	
Rail Mill		88.7								
Rails	101,094		49,177	48.64	-		51,917	51.36	-	
Strls.	34,050		29,378	86.28	3,697	10.86	-		975	2.86
Bars	1,190		167	14.04	873	73.36	-		150	12.60
Billets	7,057		1,734	24.57	2,024	28.68	1,044	14.79	2,255	31.96
Blooms	-		-		-	-		-	-	
Merchant Mills, 1&2		93.2								
Strls.	71,788		56,992	79.39	2,266	3.16	-	-	12,530	17.45
Bars.	233,220		181,045	77.63	7,480	3.21	-		44,695	19.16

PTO

Annexure V - 6 (Contd)

Section:	Gross Production t.	Gross yield %	Tested and Commercial t.	Tested and Commercial %	Defectives t.	Defectives %	Untested t.	Untested %	Off-grade t.	Off-grade %
S.MILL:		87.6								
	103,829		91,637	88.26	9,252	8.91	-		2,940	2.83
	18,619		11,929	64.07	2,172	11.66	-		4,518	24.27
ss Blooms	41,733		41,733	100.00	-		-		-	
Rails	123		-		5	4.07	118	95.93	-	
rs.	5,687		5,666	99.63	21	0.37	-		-	
;	337		220	63.27	109	32.36	8	2.37	-	
Mill:		78.7								
s	110.019		92,662	84.22	10,429	9.48	-		6,928	6.30
Mills:										
.Sheets	27,705	77.2	27,390	98.86	315	1.14	-		-	
Sheets	69,322		18,818	27.15	6,503	9.36	44,001	63.49		
Sheets.	66,158		16,821	25.43	5,933	8.97	43,404	65.60	-	
& Strip Mills		94.4								
& Strip	186,401		154,539	82,91	-		31,862	17.09	-	
.A.Plant:										
s & Tyres	17,997	62.6*	17,997	100.00	-		-		-	
	6,473	52.1*	6,473	100.00	-		-		-	
Total	1465,438	77.95	1063,410	72.56	96,780	6.61	179,355	12.24	125,943	8.59

* Ingot to Saleable Steel Yield.

Annexure - V-7

ame of Prouder: Tata Iron & Steel Co. Ltd.

Mill Performance during 1969-70

ill & Section	Gross Production	Gross Yield	Tested and commercial		Defectives		Untested		Off-Grade	
	t.	%	t	%	t	%	t	%	t	%
looming Mill No. 1		89.9								
looms	3,331		1,034	31.04	2,160	64.85	137	4.11	-	-
labs	1,600		415	25.94	53	3.31	1,132	70.75	-	-
looming Mill No.2		86.4								
looms	6,263		1,403	22.40	2,990	47.74	1,870	29.86	-	-
labs	5,824		1,281	22.00	431	7.40	4,089	70.21	23	0.39
.B.&.B.M.NO.1.		96.5								
illets	135,660		94,272	69.49	9,017	6.64	-	-	32,371	23.87
looms	11,290		532	4.71	4,196	37.17	6,562	58.12	-	-
kelp Bars(Slabs)	8,689		-	-	8,674	99.83	15	0.17	-	-
.B.&.M.NO.2		95.6								
illets	115,617		101,986	88.21	2,480	2.15	-	-	11,151	9.64
looms	9,110		2,338	25.66	2,472	27.13	4,300	47.21	-	-
kelp Bars	14,822		1,354	9.14	11,711	79.01	1,757	11.85	-	-
in Bars	76,455		76,166	99.62	289	0.38	-	-	-	-
ail Mill:		90.3								
ails	96,791		42,254	43.66	-	-	54,537	56.34	-	-
trls.	21,696		18,879	83.33	2,920	13.46	-	-	697	3.21
ars	1,966		879	44.71	739	37.59	-	-	348	17.70
illets	10,819		8,192	75.72	2,627	24.28	-	-	-	-
looms	234		234	100.00	-	-	-	-	-	-
erchant Mills.1&2		93.4								
trls.	31,737		25,769	81.20	1,486	4.68	-	-	4,482	14.12
ars.	267,764		221,871	82.86	7,265	2.71	-	-	38,628	14.43

(Annexure V-7(contd)

Mill & Section	Gross Production t	Gross Yield %	Tested and Commercial t.	Tested and Commercial %	Defectives t.	Defectives %	Untested t.	Untested %	Off-Grade t.	Off-Grade %
M&L.S.MILL:		88.7								
Strls.	97,124		85,907	88.45	7,621	7.84	-	-	3,596	3.71
Bars.	18,379		10,514	57.21	3,752	20.41	-	-	4,113	22.38
Seamless Blooms	32,376		32,376	100.00	-	-	-	-	-	-
Light rails	663		48	7.23	150	22.63	465	70.14		
Hoe Bars	6,399		4,061	63.46	19	0.28	-	-	2,319	36.26
Other Bars & Billets	435		147	33.80	103	23.68	-	-	185	42.52
Plate Mill		78.9								
Plates	103,855		85,504	82.33	13,674	13.17	-	-	4,677	4.50
Sheet Mills:		77.4								
High Si. Sheets	33,252		32,751	98.49	501	1.51			-	-
Black Sheets	76,103		20,523	26.97	8,345	10.97	47,235	62.06	-	-
Galv. Sheets	50,113		13,361	26.67	4,642	9.26	32,110	64.07		
Skelp & Strip Mill		94.5								
Skelp & Strip	179,020		154,292	86.19	-	-	24,728	13.81	-	-
W.T.&.A. Plant										
Sheets & Tyres	15,312	61.8*	16,312	100.00	-	-	-	-	-	-
Axles	6,332	58.8*	6,332	100.00	-	-	-	-	-	-
Grand Total:	1[illegible]0,031	78.8*	1060,187	73.62	98.317	6.83	178.937	12.43	102.590	7.12

* Ingot to Saleable Steel Yield.

Annexure -V-8

Name of the Producer: Tata Iron & Steel Co.Ltd.

Mill Performance during 1970-71

Mill & Section	Gross Production	Gross Yield	Tested and Commercial		Defective		Untested		Off-grade	
	t	%	t.	%	t.	%	t.	%	t.	%
Blooming Mill No.1		89.9								
Blooms	745		36	4.83	709	95.17	-	-	-	-
Slabs	291		-	-	28	9.62	263	90.38	-	-
Blooming Mills No.2		88.4								
Blooms	3,616		923	25.53	1,883	52.08	810	22.39	-	-
Slabs	1,763		593	33.64	175	9.93	995	56.43	-	-
S.B.&.B.M.No.1		96.5								
Billets	115,753		73,200	63.24	5,352	4.62	-	-	37,201	32.14
Blooms	5,997		814	13.58	2,347	39.14	2,836	47.28	-	-
Skelp Bars & Slabs	9,065		100	1.10	8,804	97.12	161	1.78	-	-
S.B.&.B.M.No.2		95.5.								
Billets	77,343		66,301	85.73	1,456	1.88	-	-	9,586	12.39
Blooms	8,486		3,008	35.44	1,504	17.73	3,974	46.83	-	-
Skelp Bars & Slabs	14,514		718	4.95	9,922	68.36	3,874	26.69	-	-
Tin Bars	91,050		90,778	99.70	272	0.30	-	-	-	-
Others	1,336		1,336	100.00	-	-	-	-	-	-
Rail Mill:		90.9								
Rails	54,598		40,477	74.13	-	-	14,121	25.87	-	-
Structurals	24,947		22,511	90.24	2,227	8.93	-	-	209	0.83
Bars	13,455		2,333	17.34	9,253	68.77	-	-	1,869	13.89
Billets	10,503		7,881	75.04	2,622	24.96	-	-	-	-
Blooms & Slabs	53		-	-	-	-	53	100.00	-	-
Merchant Mills 1&2		93.3.								
Structurals	47,901		40,524	84.60	1,267	2.64	-	-	6,110	12.76
Bars	270,734		233,305	86.17	5,598	2.07	-	-	31,831	11.76

PTO

Mill & Section	Gross Production t.	Gross Yield %	Tested and Commercial t.	Tested and Commercial %	Defective t.	Defective %	Untested t.	Untested %	Off-Grade t.	Off-Grade %
M.&.L.S.MILL		87.8								
Structurals	84,899		75,590	89.04	7,181	8.46	-	-	2,128	2.50
Bars	17,969		12,510	69.62	3,218	17.91	-	-	2,241	12.47
Seamless Blooms	44,836		44,836	100.00	-	-	-	-	-	-
Light Rails	319		-	-	13	4.07	306	95.93	-	-
h e Bars	6,620		1,212	18.31	6	0.09	-	-	5,402	81.60
Other Blooms	-		-	-	-		1	5.2	-	-
Billets & Skelp Bar	178		-	-	168	94.38	10	5.62	-	-
Plate Mill:		79.7								
Plates	100,898		84,659	83.90	11,679	11.57	-	-	4,560	4.53
Sheet Mills:		77.5								
Hi.Si.Sheets	39,852		38,459	96.50	1,393	3.50	-	-	-	-
Black Sheets	81,630		31,246	38.28	8,228	10.08	42,156	51.64	-	-
Gal. Sheets	42,351		13,852	32.71	3,460	8.17	25,039	59.12	-	-
Skelp & Strip Mill:		94.5								
Skelp & Strip	180,049		150,276	83.46	-	-	29,773	16.54	-	-
W.T.&.A.Plant										
Wheels & Tyres	15,813	58.8*	15,813	100.00	-	-	-	-	-	-
Axles	5,891	55.9*	5,891	100.00	-	-	-	-	-	-
Grand Total	1374,572	77.75*	1060,299	77.14	88,765	6.46	124,371	9.04	101,137	7,36

* Ingot of Saleable Steel Yield.

ANNEXURE - V - 9

Name of Producer: Tata Iron & Steel Co. Ltd.

Mill Performance during 1971-72

Mill & Section	Gross Production t.	Gross Yield %	Tested and Commercial t.	Tested and Commercial %	Defectives t.	Defectives %	Untested t.	Untested %	Off-Grade t.	Off-Grade %
Blooming Mill No.1		82.5								
Blooms	1,352		377	27.88	886	65.53	89	6.59	-	-
Blooming Mill No.2		84.23								
Blooms	3,105		1,225	39.45	1,270	40.90	610	19.65	-	-
Slabs	2,065		571	27.65	199	9.64	1,295	62.71	-	-
S.B.&.B.M.No.1		96.5								
Billets	109,730		77,793	70.89	4,400	4.01	-	-	27,537	25.10
Blooms	6,451		44	0.68	1,743	27.02	4,664	72.30	-	-
(Slab)Skelp Bar	17,975		1 4	-	7,856	99.30	55	0.70	-	-
S.B.&.B.M.No.2		95.2								
Billets	73,767		66,007	89.48	832	1.13	-	-	6,928	9.39
Blooms	7,406		4,273	57.70	682	9.21	2,451	33.09	-	-
(slab) Skelp Bar	12,575		1,172	9.32	7,883	62.69	3,520	27.99	-	-
Tin Bar	103.703		102 ,943	99.27	760	0.73	-	-	-	-
Rail Mill:		90.6								
Rails	63,681		45,751	71.84	-	-	17,930	28.16	-	-
Strls.	18,563		15,717	84.67	2,627	14.15	-	-	219	1.18
Bars	16,699		1,015	6.08	15,283	91.52	-	-	401	2.40
Billets	22,240		1,233	55.04	1,007	44.96	-	-	-	-
Blooms	15		-	-	-	-	15	100.00	-	-
Merchant Mills 1 & 2		93.5.								
Strls.	58,202		49,607	85.23	1,236	2.12	-	-	7,359	12.65
Bars	239,991		204,302	85.13	3,845	1.60	-	-	31,844	13.27

PTO

Annexure V-9 (Contd)

Mill & Section	Gross Production	Gross Yield	Tested and Commercial		Defectives		Untested		Off-Grade	
	t.	%	t.	%	t.	%	t.	%	t.	%
M.&.L.S.MILL		88.1								
Strls.	88,974		78,361	88.07	7,249	8.15	-	-	3,364	3.78
Bars	118,919		14,176	74.93	75,225	17.05	-	-	1,518	8.02
Seamless	49,084		49,084	100.00	-	-	-	-	-	-
Light Rails	393		-	-	4	1.02	389	98.98	-	-
Hoe Bar	6,712		1,453	21.65	3	0.04	-	-	5,256	78.38
Other Blooms	47		10	21.28	37	78.72	-	-	-	-
Plate Mills:		81.1								
Plates	105,963		84,400	79.65	17,603	16.61	-	-	3,960	3.74
Sheet Mills:		80.7								
Hi.Si.Sheet	35,804		34,695	96.90	1,109	3.10	-	-	-	-
Black Sheet	105,061		31,171	29.67	12,651	12.04	61,239	58.29	-	-
Galv. Sheet	43,329		14,597	33.69	3,763	8.68	24,970	57.63	-	-
Skelp & Strip Mills		94.5								
Skelp & Strip	184,583		155,189	84.08	-	-	29,394	15.92	-	-
W.T.&.A.Plant:										
Wheels & Tyres	14,875	59.7*	14,875	100.00	-	-	-	-	-	-
Axles	6,119	50.4*	6,119	100.00	-	-	-	-	-	-
Grand Total:	1387,319	78.6*	1056,160	76.13	96.152	6.93	146.673	10.[illegible]	88,394	6.37

* Ingot to Saleable Steel yield.

Name of Producer: Rourkela Steel Plant

ANNEXURE V - 10

Period: 1968-'69 to Ist Qr. of 1972-'73

SALEABLE STEEL

Particulars	1968-69 Tonnes	%	1969-70 Tonnes	%	1970-71 Tonnes	%	1971-72 Tonnes	%	Ist Qr of72-73 A JUNE & 2 Tonnes	%	2nd Qr. Tonnes	%
Break-up of Saleable Steel Production by Quality Tested.	558279	72.2	575007	72.2	443390	64.9	385271	64.5	77981	58.4	123218	61.9
Materials where testing is restricted (Tin Plates & some grades of pipes)	38767	5.0	79521	10.0	98455	14.4	63790	10.7	12462	9.3	18774	9.4
Untested/off-grade	146030	18.9	121271	15.3	118567	17.3	129297	21.6	38719	29.1	49652	24.9
Defectives	30265	3.9	20214	2.5	23188	3.4	19095	3.2	4290	3.2	7518	3.8
Total Saleable Steel	773341		796013		683600		597453		133452			
Total Scrap Arisings in Rolling Mills (Tonnes)	274114		250240		246532		201764		Not readily available			

It is expected that case go to 62 - 64% immediately
and then go to 70% etc
After Cold Stocks eliminated

Name of the Producer: Rourkela Steel Plant
Period 1968-69

ANNEXURE V-11
Mill Performance

Categories (Millwise/ Production.	Saleable Steel Prodn. Net Excl: rejections.	Net yield % Excl:rejections		Tested		Defectives		Untested & off-grades	
		Standard	Actual	Quantity (Tonnes)	%of Saleable steel (actual)	Quantity (Tonnes)	% of Saleable steel (actuals)	Quant.	% Salable steel(Ac)
1.	2.	3.	4.	5.	6.	7.	8.	9.	10
Slabbing Mill									
Slabs for sale (Seris)	1465	85.5	83.3	1356	92.6	-	-	109	7.4
Plate Mill-Plates	181776	79.5	79.6	146064	80.4	-	-	35712	19.6
HOT STRIP Mill: H.R. Coils	206212	96.5	96.0	186215	90.3	-	-	19977	9.7
H.R. Sheets & Plates (incl: Plates from Pipe Plant)	133000	94.0	94.5	76359	57.4	10897	8.2	45744	34.4
E.S. Mill: HR/SI Sheets	2500	-	62.8	2092	82.7	408	16.3	-	-
Pipe Plant-ERW Pipe	34269		89.0	21694 12575*	63.3.	-	-	-	-
C.R.Mill: CR Coils	39767			27748	69.8			12019	30.2
CR Sheets & Black Plates.	96554	87.4	85.3	49223	51.0	17103	17.7	30228	31.3
Galvanished Sheets	51606		89.5	47528	92.1	1857	3.6	2221	4.3
H.D.T.P.*	24235	69.4	64.2	24235	-	-	-	-	-
E.T.P.*	1957		N.A.	1957*	-	-	-	-	-
Total Saleable Steel	773341			558273 38767*	72.2 5.0*	30265	3.9	146030	18.9

* Material where testing is restricted.

Remarks (1) "Standard" refer to norms as per norms committees' report, issued in 1969.

(2) No norms are available for tested, untested/off-grade defective production and hence the corresponding columns are ommitted.

(3) Yield corresponds to yield from H.R. Coils in case of CRM Product.

Name of the Producer: Rourkela Steel Plant
Period: 1969-70

ANNEXURE V - 11(Contd)

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Slabbing Mill-Slabs for Sale	545	85.5	85.5	545	100.00	-	-	-	-
Plates Mill-Plates	185425	79.5	79.6	154181	83.2.	-	-	31244	16.8
Hot Strip Mill									
HR Coils	244774	96.5	95.8	220903	90.2	-	-	23871	9.8
HR Sheets & Plates (incl plates from pipe Plant)	64609	94.0	96.1	31146	48.2	4504	7.0	28959	44.8
TS Mill: HR 'Si' Sheets.	10896	-	65.9	9592	88.0	1303	11.9	-	-
Pipe Plant-ERW Pipes	37916		88.0	7763 30153*	20.5	-	-	-	-
C.R.Mill-CR Coils	30275			21560	71.2			8715	28.8
C.R. Sheets & Black Plates	83479	87.4 (CR Sheets)	87.6	45623	54.7	12187	14.6	25669	30.7
Galvanished Sheets	88727		91.2	83694	94.3	2220	2.5	2813	3.2
H.D.T.P.*	16861	69.4	59.4	16861*	-	-	-	-	-
E.T.P.*	32507	[illegible]	77.8	32507*	-	-	-	-	-
Total Saleable Steel	796013			575007 79521*	72.2. 10.0*	20214	2.5	121271	15.3

* Materials where testing is restricted.

Remarks: Same as given for 1968-69.

Name of the Producer: Rourkela Steel Plant
Period: 1970-71

SALEABLE STEEL

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Slabbing Mill-Slabs for Sale	280	85.5	86.2	280	100.00	-	-	-	-
Plates Mill-Plates	150234	79.5	80.1	125168	83.3	-	-	25066	16.7
Hot Strip Mill-HR Coils	104104	96.5	95.4	86407	83.0	-	-	17697	17.0
HR Sheets & Plates (incl Plates from Pipe Plant)	68283	94.0	96.4	27925	40.9	3720	5.5	36638	53.6
E.S.Mill - HR 'Si' Sheets	12353		53.1	11433	92.6	920	7.4	-	-
Pipe Plant - ERW Pipes	38592		88.1	3404 35188*	8.8	-	-	-	-
C.R. Mill -C.R.Coils	58010		4.0	44938	77.5	-	-	13072	22.5
C.R. Sheets & Black Plates	95146	87.4 (CR. Sheets)	86.8	59418	62.4	11757	12.4	23971	25.2
Galvanished Sheets	90456		90.4	84417	93.3	3916	4.3	2123	2.4
H.D.T.P.*	14425	69.4	60.4	14425*					
F.T.P.*	51717		83.9	48842*		2875	5.6		
Total Saleable Steel	683600			443390 98455*	64.9 14.4*	23188	3.4	118567	17.3

* Materials where testing is restricted.

Remarks: Same as for 1968-'69.

ANNEXURE V-11(Contd)

Name of the Producer: Rourkela Steel Plant

Period: 1971 - '72

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Slabbing Mill: Slabs for sale	563	85.5	85.6	563	100.00	-	-	-	-
Plate Mill: Plates	143256	79.5	79.9	106907	74.6	-	-	36349	25.4
Hot Strip Mill- HR. Coils	79884	96.5	95.6	65615	82.1	-	-	14269	17.9
HR.Sheets & Plates (incl:Plates from Pipe Plant)	65849	94.0	96.6	32321	49.2	3608	5.5	29756	45.3
E./S.Mill: H.R.'Si[illegible] Sheets.	8003		61.9	7696	96.2	307	3.8	-	-
Pipe Plant: ERW Pipes	34919		88.3	7876	22.6	-	-	-	-
C.R.Mill: CR Coils	50420			27043* 33309	66.			17111	33.9
C.R.Sheets & Black Plates	102702	87.4 (C.R.Sheets)	82.5	62730	61.	9488	9.2	30484	29.7
Galvanised Sheets	72102		89.0	68254	94.	2684	3.7	1164	1.6
H.D.T.P.*	5965	69.4	58.1	5965*	-	-	-	-	-
E.T.P.*	33790		83.8	30782*	-	3008	8.9	-	-
Total Saleable ~~Tin~~ Steel ~~Plates~~.	597453			385271 63790	64.5 10.7	19095	3.2	129297	21.6

* Materials where testing is restricted

Remarks: Same as given for 1968-'69.

Name of the Producer: Rourkela Steel Plant

Period: 1968-'69 to 1971-'72

ANNEXURE V - 12

SCRAP ARISINGS IN ROLLING MILLS

(Total Scrap including Industrial Scrap & Scrap for Melting within the Plant)

MILL	1968-'69		1969-'70		1970-'71		1971-'72	
	Tonnes	%	Tonnes	% %	Tonnes	% %	Tonnes	% %
Slabbing Mill	187188	15.3	135842	12.4	128653	13.0	109012	12.7
Plate Mill	40335	17.1	37033	15.3	30963	15.9	33314	17.9
Hot Strip Mill	24655	3.7	21557	3.1	25270	4.0	12580	2.4
Electric Sheet Mill	2453	32.9	5159	34.0	6250	32.2	4844	36.9
Pipe Plant	4218	11.0	5161	12.0	5215	11.9	4609	11.7
Cold Rolling Mill	35235	14.5	45488	16.0	50181	13.8	37405	12.1
Total Mill Scrap	274114	-	250240	-	246532	-	201764	-

% is expressed on the first stage input within each mill.

NAME OF THE PLANT

BHILAI STEEL PLANT
MILL PERFORMANCE

ANNEXURE V-13

Sl. No.	Categories (Millwise/ product-wise.	Period	Gross Production	Gross Yield from input Std.	Gross Yield from input Actual	Tested & Commercial Quantity	% Gross Production Std.	% Gross Production Act.	Off-Grade and Untested Quantity	% Gr. Production Std.	% Gr. Production Act.
1.	BLOOMS	1968-69	1406749	85.7	86.6	1496249		99.9	500		0.1
		1969-70	1585348		86.0	1579398		99.6	5950		0.4
		1970-71	1703484		87.3	1692290	*	99.3	11194	*	0.7
		1971-72	1643846		87.8	1618741		98.5	8835		0.5
	1st Qr.	1972-73	437144		87.9	425318		97.3	10063		2.3
2.	BILLETS	1968-69	939494		96.6	795741		84.7	107758		11.4
		1969-70	1005588		98.7	856004		85.1	115668		11.5
		1970-71	1079377	95.7	97.0	882423	*	81.8	189220	*	17.5
		1971-72	1100008		97.5	935688		85.1	128708		11.7
	1st Qr.	1972-73	283814		97.7	216346		75.9	52850		18.9
3.	RAILS	1968-69	246922		90.7	183310		74.2	63612		25.8
		1969-70	267406		91.7	178816		66.9	88590		33.1
		1970-71	278551	92.0	91.0	178772	*	64.2	99779	*	35.8
		1971-72	258945		92.4	194948		75.3	63997		24.7
	1st Qr.	1972-73	58601		93.5	50940		86.9	7661		13.1
4.	HEAVY STRUCTURALS & BARS.	1968-69	231828		85.2	196338		84.7	26404		11.4
		1969-70	264378		89.2	207489		78.3	47820		18.1
		1970-71	245918	90.0	89.6	187450	*	76.2	50908		20.7
		1971-72	176004		89.6	144917		82.4	20489		11.6
	1st Qr.	1972-73	60552		88.9	42245		69.8	15689		25.9
5.	MERCHANT PRODUCTS.	1968-69	328603		93.2	293734		89.4	31626		9.6
		1969-70	420424		94.7	385826		91.8	30813		7.3
		1970-71	453465	94.0	95.7	418412		92.3	31752		7.0
		1971-72	346762		96.5	313344		90.4	31373		9.0
	1st. Qr.	1972-73	116529		96.8	94494		81.1	21598		18.5
6.	WIRE RODS.	1968-69	119102		90.6	110215		92.6	875		0.7
		1969-70	237260		92.7	228610		96.3	1850		0.8
		1970-71	298002	96.1	94.2	285376		97.7	7722		2.6
		1971-72	298164		95.0	292330		98.0	1748		0.6
	1st Qr.	1972-73	80448		95.3	79122		98.4	435		0.5

Total Defectives. Quantity	% Gross Prodc. Std.	% Gross Prodc. Act.	Scrap for Re Rolling. Qty.	% Gr. Prodc. S	% Gr. Prodc. A.	Industrial Scrap. (Cutting) Qty.	% Gr. Prodn. S.	% Gr. Prodn. A.	Remelting Scrap (Estimated.) Qty.	% Gross of Prodn. Std.	% Gross of Prodn. Act.	Remarks
-	-								207428		13.9	
-	-								211026	13.3	13.3	
-	-								19796		10.2	
16270	*	1.0							181153		9.7	
1763		0.4							47586		10.8	
35995		3.9							28667		3.1	
33916		3.4							8369		0.8	
7734	*	0.7							27568	3.9	2.6	
35612		3.2							22281		2.2	
14618		5.2							5271		1.9	
-		-							17159		6.9	
-		-							13674		5.1	
-	*	-							14628	5.8	5.3	
-		-							130[illegible]		5.1	
-		-							2321		4.0	
9086		3.9							26035		11.2	
9569		3.6							18839		7.1	
7560		3.1							20960	8.1	8.5	
10598		6.9							14642		8.3	
2618		4.3							5158		8.5	
3243		1.0							14402		4.4	
3785		0.9							13012		3.1	
3301		0.7							11556	3.6	2.5	
2045		0.6							7367		2.1	
437		0.4							2143		1.8	
8012		6.7							7736		6.5	
6800		2.9							11200		4.7	
4904		1.7							8811	1.9	2.9	
4086		1.4							6330		2.1	
891		1.1							1835		2.2	